

Establishment of a GPS Constellation in Orbit of Other Planets to Facilitate Landing Operations

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Introduction

One of the challenges associated with landing craft upon the surface of other planets such as Mars is associated with the challenge both of assessing altitude (essential for knowing when to begin to decelerate) and of ensuring that craft land in the intended area. When spacecraft land in areas other than the intended area; on the side of a mountain rather than on a flat plain, for example; a craft may wind up sustaining serious damage as a consequence of tumbling down a mountainside and contact with the craft may be consequently lost.

In order to facilitate return trips for human-crewed flights to Mars, for example, booster rockets on the scale of the Saturn V or perhaps larger would be needed and would have to land upright in order to allow for a crew to have any hope of returning home. Precision guidance, in all cases, is required and this sort of guidance can only be provided by a GPS constellation.

Abstract

In order to establish a GPS constellation around an alien world, the same work which was done in the calibration of Earth's GPS system would need to be done without the benefit of easy access to the alien world. The shape and composition of the planet and the gravitational influence of any natural satellites have to be taken into account. The position of the satellites relative to the surface of the planet have to be known and stabilized, something made possible using LiDAR measurements taken by those very satellites.

However, in order to calibrate the GPS system, one would need to deploy a craft capable not only of "pacing off" specific distances in any given direction on the surface of that planet, but also capable of pacing off distances in three dimensions through flight. As Mars, for example, has a thin atmosphere, one might use a miniature helicopter with rotors turning at exceptional velocity in order to achieve that end.

Conclusion

Interestingly, it may be possible to use signals transmitted in the opposite direction from such a system (i.e. back to Earth,) once the position of the satellites in orbit of Mars are known and fixed, those same satellites could be used to facilitate GPS service here on Earth, as well, if with reduced signal strength. As these satellites would be, at minimum, 30 million miles away, they would be easier to jam but more difficult to destroy.